WHEEL-BALANCING DEVICE AND WHEEL EQUIPPED WITH SUCH A BALANCING DEVICE

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to balancing wheels of vehicles provided with tires.

2. DESCRIPTION OF THE RELATED ART

If it happens for some reason that the wheel of a vehicle becomes unbalanced, the best known way to remedy this defect is to place weights on the rim of the wheel at appropriately selected points, the weight and position of which re-establish the faulty equilibrium. This technique has the particular disadvantage that the springs, that ensure a firm fit between each weight and the rim, cause permanent local scratches on the rim when the springs are being installed such that when it is necessary to replace the weights when a new balancing is performed, the marks left by these springs remain visible and the appearance of the rim is displeasing. It should be noted that this principle is not possible for all types of rims; in fact, balancing weights are in practice arranged on the peripheral edges of the rim which ensures an excellent retention of the weights with regard to centrifugal force. Thus, standard weights cannot be mounted on the rims of wheels that are not provided with such peripheral edges.

French Patent No. 1,151,191 proposes a balancing principle capable of being used in the previously-mentioned case of rims that are not provided with peripheral edges. This patent discloses a vehicle wheel-balancing device that can be easily installed and easily removed and which is nevertheless securely fitted without

separation despite the relative high stresses to which the device can be subjected. It is proposed to encircle the balancing weight with a belt or band attached to the rim of the wheel. It is pointed out that the belt is advantageously firmly fixed to the weight: it is preferably attached by weld points between the hasps of the belt and the rim and it is specified that this allows the device to be installed and removed several times as the weld points can be broken using a cutter or the like. It is clear that this solution has the disadvantages outlined above with regard to the attachment springs because the welding operations and then subsequent separation by a cutter device inevitably leave displeasing marks. Moreover, rims that do not have edges are not generally made of weldable materials (aluminum rims, for example).

More recently, it was proposed to balance wheels by securing the weights onto the rim using an adhesive layer with which the weights are provided. However, the adherence of the weights proved to be unreliable for use, in particular when washing the wheels under intense pressure. Moreover, the displeasing appearance was still present, particularly for aluminum rims (visible lumps or adhesive fragments remaining stuck to the rim).

U.S. Patent No. 3,786,850 discloses a balancing principle directed at combining the balancing and personalization of a wheel. This reference proposes to replace standard lead balancing weights by very visible weights to which characteristic shapes are given (letters, numbers, symbols, etc.) and which are stuck to the tire to form attractive and characteristic designs. The weights are preferably made of rubber, for example loaded with reflective particles or with decorative metallic particles, to make them as visible as possible. According to the patent, the balancing weights are not to be removed as the visible balancing weights are intended to

discourage theft. The choice of rubber to produce the balancing weights gives each weight a moderate mass compared to that of a lead balancing weight which means that the forces of centrifugal origin applied to each weight are much weaker than with lead weights. On the other hand, in practice, numerous balancing weights are required to balance a wheel (it was even contemplated to exceed the total balancing weight required, and to add, on the opposite side of the wheel axle, additional characters compensating for the excess weight); without doubt, much time is required to correctly install all the balancing weights required. The teachings of the patent are therefore completely incompatible with any attempt to balance a wheel quickly or to carry out balancing in a discreet fashion.

BRIEF SUMMARY OF THE INVENTION

The present invention is a balancing device that permits a wheel to be balanced rapidly and easily regardless of the characteristics of the rim. The balancing device is advantageously adapted to resist significant mechanical stresses (centrifugal forces occurring while driving at high speed as well as stresses generated when, for example, scraping against the curb of a pavement), the presence of which can be very discreet and which leaves barely visible traces when removed for a new balancing.

To this end, the invention proposes a balancing device for a wheel that embodies a balancing weight enclosed in a case, the surface of which is adapted to be integral with a tire and which is made of material having a similar color to that of a tire.

The invention also proposes a wheel with a rim having an axle, a tire and balancing device having a balancing weight enclosed in a case, the surface of

which is integral with a surface of the tire and which is made of a material having a similar colour to that of the tire.

It can be easily understood that, as the balancing weight is attached by its case to the tire of a wheel, the implementation of the balancing device does not depend on the characteristics of the rim. Moreover, a material of any chosen density can be used for the balancing weight, for example lead as in the previously mentioned balancing procedure, without having to worry about its connection to the wheel; the number of balancing devices to be installed during balancing of a wheel is therefore as low as with the standard lead weights. The attachment of the balancing device to the wheel is ensured by the case, the material of which can be chosen for its bonding qualities to the material of the tire without worrying about its density; it is thus possible to choose a material for the case that can be easily and firmly mounted to the tire and which guarantees that the attachment will resist significant stresses. Choosing a material for the case that is almost the same color as the tire does not pose any problem in this respect (it is sufficient to choose a material for the case that is almost identical to that of a tire). It is not necessary that the pairing formed by the material chosen to constitute the balancing weight and the material chosen for the case be easily firmly physically attached to each other as the weight is enclosed in the case, and that the retention of the weight in the case can optionally be obtained without bonding by gluing or welding between these two materials. In fact, as the weight is hidden, it can be given a specific geometry permitting a good physical anchorage (by geometry) of the case, with, for example, cavities, grooves, ribs, cross-cut passages, etc. into which the material of the case penetrates or alternatively which can be anchored in the thickness of the case. The preparation of the surface of the case

can be a glue coating such that the balancing device is easily installed by exposing the coated surface to the air and applying it to an appropriate zone of the tire (in practice, a side). If it is necessary to change the position of the balancing devices during a subsequent balancing, it is sufficient to remove the existing devices by cutting the case between the balancing weight and the part of the case that is glued to the tire; since the case is made of a material of similar color to that of the tire, the residual part of the case is hardly visible.

According to preferred characteristics of the invention, that may optionally be combined:

the weight is a lead, lead alloy, iron alloy, zinc-aluminum alloy, or even a plastic material;

the surface is a convex section, a concave section, or is at least approximately a portion of a cylinder;

the weight has an approximately rectangular section;

the case has an approximately constant thickness;

the case is made of a flexible material (as an alternative, it is rigid), preferably rubber based;

the case embodies sections occupying passages passing through the weight;

the case is glued to the surface of the weight;

the surface is delimited by borders which define edges;

the surface is pre-coated with glue;

the surface is provided with a tape, the surfaces of which are coated with adhesive; and

the case is preferably black, but may be white or green;

According to preferred characteristics of the wheel according to the invention, that may optionally be combined:

the balancing device is arranged along the side of the tire, close to the rim;

the device is arranged radially between the rim and a portion of maximum width of the tire;

the balancing device is disposed radially along the inside of a sidewall of the tire;

the balancing device is disposed radially along the outside of a sidewall of the tire;

the balancing device is engaged in a circumferential groove provided in the tire; and

the balancing device is engaged with a circumferential groove provided by the tire and an edge of the rim.

Further features, characteristics and advantages of the invention will be apparent from the description that follows, when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Figure 1 is an elevational view of a wheel according to the invention;

Figure 2 is a transverse cross-sectional view of the upper part of the wheel of Figure 1;

Figure 3 is a transverse cross-sectional view of the upper part of another embodiment of a wheel according to the invention;

Figure 4 is an elevational view of the upper part of the wheel of Figure 3;

Figure 5 is a transverse cross-sectional view of the upper part of yet another embodiment of a wheel according to the invention;

Figure 6 is an elevational view of the upper part of the wheel of Figure 5;

Figure 7 is a transverse cross-sectional view of the upper part of a fourth embodiment of a wheel according to the invention;

Figure 8 is an elevational view of the upper part of the wheel of Figure 7;

Figure 9 is a transverse cross-sectional view of the upper part of a fifth embodiment of a wheel according to the invention;

Figure 10 is an elevational view of the upper part of the wheel of Figure 9;

Figure 11 is a longitudinal cross-sectional view of a first balancing device according to the invention;

Figure 12 is a transverse cross-sectional view of the balancing device of Figure 11;

Figure 13 is a longitudinal cross-sectional view of a second balancing device according to the invention;

Figure 14 is a transverse cross-sectional view of the balancing device of Figure 13;

Figure 15 is a longitudinal cross-sectional view of a third balancing device according to the invention;

Figure 16 is a transverse cross-sectional view of the balancing device of Figure 15;

Figure 17 is a longitudinal cross-sectional view of a fourth balancing device according to the invention;

Figure 18 is a transverse cross-sectional view of the balancing device of Figure 17;

Figure 19 is a longitudinal cross-sectional view of a fifth balancing device according to the invention;

Figure 20 is a transverse cross-sectional view of the balancing device of Figure 19;

Figure 21 is a perspective diagrammatic view of a balancing device in the process of being coated with glue;

Figure 22 is an end view of the balancing device of Figure 21;

Figure 23 is a perspective diagrammatic view of a second balancing device, the front of which has been pre-coated with glue;

Figure 24 is an end view of the balancing device of Figure 23;

Figure 25 is a perspective diagrammatic view of a third balancing device that is provided with an adhesive tape; and

Figure 26 is an end view of the balancing device of Figure 25.

DETAILED DESCRIPTION OF THE INVENTION

Figures 1 and 2 illustrate a wheel 1 having a rim 2 that is adapted to turn about an axis of rotation Z-Z and a tire 3 engaged around the rim. The tire is of any type adapted for use on a vehicle wheel. The tire is provided on each of its sides

3A with a balancing device 4. Indeed, it may have only one balancing device, on one side only.

As shown, the balancing device 4 is at a distance from an edge 2A of the rim on which the balancing weights are usually attached; however, it is preferably arranged radially between the rim and a bulging part 3B of the tire which has a maximum width. This has the notable advantage of maintaining the balancing device close to the rim and to guarantee that the centrifugal forces that prevail will in part be taken up by the bulging part 3B of the tire.

The balancing device 4 is essentially a balancing weight 5 and a case 6 in which the weight is enclosed. The material of the case 6 is of a color essentially identical to that of the material of the tire.

This balancing weight 5 can be a standard weight as currently manufactured but without its attachment spring. As for the case 6, it can be obtained by molding around the balancing weight; it is preferably made of a material identical or similar to that of which the tire of the wheel is itself made, which is favorable to a good attachment between tire and case; as this material is essentially the same color as the tire, the presence of the weight enclosed in its case is hardly visible. This small balancing device 4 is attached by at least one of its surfaces, treated to this end, to the side of the tire, for example by gluing. If balancing is shown to be necessary, the operator is provided with the balancing device described above (after he identifies the weight characteristic according to conventional balancing procedures), and applies it firmly to the desired place, directly on the side of the tire almost at the level of the rim.

The balancing device 4 thus fulfills its balancing function by being hardly visible and leaving the tire and rim intact if it is removed.

In fact, if a new balancing becomes necessary at some stage, the operator cuts off the external part of the case concerned, using a cutting instrument, thus freeing the majority of the case at the same time as the weight which it encloses, leaving only the internal part of the case (one side) on the tire, which remains glued to the tire with which it blends, being of the same type and the same color. In this case, removal of the lead is no longer displeasing as is the case with balancing weights attached to the rim.

Installation of the lead balancing weights on any vehicle wheel which are necessary for balancing it is thus simple and reliable. Further, because it is possible to select a material for the case that is different from that of the balancing weight, it is easy to ensure a very good mechanical bond between the case and tire.

The material of the weight 5 is preferably of standard lead (lead or lead alloy) but can also be of another material such as steel, cast iron, zinc and aluminum alloy of zamac type, ferrous or non-ferrous alloy, or even plastic (for example polypropylene, etc.).

The case has a thickness that is preferably approximately constant (for example of the order of one millimeter) such that the shape of the weight essentially determines that of the balancing device.

The geometry of the weights 5 can be that of current weights.

To ensure that the balancing device 4 fits the tire well, the balancing device can:

be entirely shaped as the arc of a circle to follow the round shape of the edge of the rim (Figure 1); and/or

have a concave surface 4A, intended to run along the tire so as to follow the round form of the side of the tire (Figure 2).

In the example of Figures 3 and 4, a balancing device marked 14 runs along inside an edge 13A of a tire 13 arranged radially inside an edge 12A of the rim 12; in this case, a weight 15 advantageously has a convex surface parallel to a convex surface 14A of the block running along the tire, while the opposite surface (Figure 4) can be straight (in fact, the geometry of this opposite surface is of little importance). Here, there are two balancing devices arranged on the two internal edges of the tire.

In the example of Figures 5 and 6, where each balancing device 24 is arranged radially outside a side wall 23A of a tire 23, radially to the outside of an edge 22A of a rim 22, a weight 25 advantageously has a concave surface parallel to a concave surface 24A of the block intended to follow the convex shape of the sidewall of the tire; the geometry of the opposite surface of the weight (in Figure 6) can be as desired, for example convex or plane, in particular. Here, there are also two balancing devices on two sides of the plane of the wheel.

In the previously mentioned examples, the balancing device is installed in an available zone of the tire without this having necessarily been designed to receive balancing devices according to the invention.

In Figures 7 to 10, the balancing device 34 (in Figures 7 and 8) or 44 (in Figures 9 and 10) is engaged in a circumferential groove or channel 33A or 43A of a tire 33 or 43 provided to this end, here radially to the outside of a free edge 32A or 42A of a rim 32 or 42. In Figures 7 and 8, the balancing device 34 is a section of

piping engaged wholly or partially in the circumferential groove 33A of the tire 33 and a case 36 surrounding a balancing weight 35 is an arched section (Figure 8) which has at least one surface 34A which is highly curved (Figure 7), at least approximately in the shape of a section of a cylinder (here essentially a half-cylinder) intended to follow the internal surface of the circumferential groove 33A. In Figures 9 and 10, the balancing device 44 is an arched section received in the channel 43A of the tire 43 defining a groove with the free edge 42A of the rim; the balancing device 44 does not occupy all the section of the groove, remaining at a distance from the free edge 42A. A case 46 surrounding a weight 45 has an arched shape with a convex surface 44A intended to run along the internal sidewall presented by the tire opposite the free edge 42A (as in the case of Figures 3 and 4, the internal radial section of the weight can be as desired, concave or plane, in particular). As previously, a balancing device can be provided on the internal and/or external side of the wheel, according to the location where the tire was equipped to this end.

The case of each of these previously mentioned balancing devices can be made of various materials, in practice of plastic or polymer-type material or of rubber-like material; for example, an EPDM-type material can be used, but PVC can also be used. The case can be flexible or rigid according to the material chosen, and is made preferably around the weight, for example by duplicate molding. Completely surrounding the weight with the case means that the weight is firmly affixed to the case such that it forms a block.

The cohesion of the block is sufficiently ensured by the mechanical resistance of the case which holds the weight (Figures 11 and 12), but it is obviously

improved by the possible adherence obtained between the weight and the case material along their interfaces during manufacture, for example by duplicate molding.

The cohesion of the block can be reinforced either:

by mechanical retention or anchorage of the case through the weight with one passage 60 (Figures 13 and 14), two passages 60 (Figures 15 and 16), even several passages 60 (Figures 17 and 18) through the weight; or

by the insertion of a gluing product 70 between the weight and case (Figures 19 and 20) in order to obtain a good adherence over all the contact surface.

The color of the material of the case is chosen to be identical to that of the tire (black, white, green, etc.) in order to render the block practically invisible once it is installed on the tire; it should be noted that a person skilled in the art knows how to dye plastic or rubber materials that can be used for the case without difficulty.

In practice, as with known balancing weights, the shape and transverse dimensions (in a plane of the wheel) can be fixed and the differences in weight are obtained by differences in thickness (parallel to the axis of rotation). As a variant, the procedure can be carried out in reverse, by varying the dimension of the circumference, or even by varying several dimensions.

The balancing procedure begins with the choice of a weight device capable of compensating for the imbalance determined on the wheel in question (apparatus exists for this for standard weights and can be easily provided as a function of the distance to the axis at which the balancing devices are intended to be attached onto the tire).

The surface of the case that is intended to be firmly mounted to the tire is advantageously treated subsequently. This treatment could merely consist of giving

it the desired geometry: in practice the geometry merely follows the complementary shape of the tire. To ensure optimal mounting, this surface is advantageously bordered by sharp borders defining edges 80; this avoids the formation of splits between the block and the tire capable of constituting incipient cracks which can then spread into the mounting surface between the block and the tire. As a variant, the block sections can be tapered or in the shape of lips in order to follow the length of the tire surface (this is obtained for example by giving the block a trapezoidal section, the large base of which is intended to extend along the surface of the tire).

One way of obtaining an optimal adhesion is to ensure that the surfaces of the tire and the block are clean and dry:

a preliminary scraping of the surfaces allows the rubber to be "reactivated";

then the surfaces are cleaned with a solvent, for example heptane; a mixture of isopropyl alcohol and water can also be used, etc.; and

the block can be attached to the tire by glue (for example of cyanoacrylate type), for example that sold by LOCTITE under the reference 406.

Figures 21 and 22 show a block or balancing device 4 according to the invention in the process of being coated with glue 85 just before being glued against the corresponding surface of a tire. As a variant represented by Figures 23 and 24, the block 4' is pre-coated with glue during manufacture and, when it is desired to attach it to a tire, an optional protection film is removed to expose a layer of strongly adhesive glue 90. Figures 25 and 26 illustrate another variation where the coating of the mounting surface of the block 4" is a tape 95, for example coated on both surfaces with a thermoreactivatable adhesive; after removal of an optional protection film, it is sufficient to reactivate the adhesive.

As a variant, the layer of adhesive glue 90 or the tape 95 can be put in place at the last moment.

The block thus coated with glue (according to any one of the variants presented in Figures 21 to 26) is then positioned on the tire at the desired position with an application of pressure for several seconds. The balancing procedure is then finished.

Other mounting solutions can be utilized, for example, local vulcanization.

As a general rule, in the examples represented, the weight and thus the balancing block have an overall possibly arched parallelepiped shape, except in the case of Figures 7 and 8. Mounting to the tire can be done, in these cases, on a single surface (Figures 2 to 4), on two surfaces (Figures 5, 6, 9 and 10) or a highly curved surface in a plane containing the axis of rotation (Figures 7 and 8), being able to be a semi-cylindrical surface (possibly arched to follow the circumference of the tire).

If a new balancing is required (assuming that the tire is to be retained):

either the previous block is left if it does not interfere with the attachment of a new block; or

it is cut gently at the level of the glued surface.

The balancing devices according to the present invention are perfectly compatible with existing tires and can be adapted without difficulty to tires currently in development and which are the subject of new methods of attachment to the rim (example: tire with vertical fastening).

Although particular embodiments of the present invention have been illustrated in the accompanying drawings and described in the foregoing detailed

description, it is to be understood that the present invention is not to be limited to just the embodiments disclosed. Rearrangements, modifications, and substitutions are possible, without departing from the scope of the claims hereafter.

What is claimed is: